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U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
California Forest and Range Experiment Station
Division of Forest Insect Research

FOREST INSECT AERIAL SURVEY
CALIFORNIA REGION
FALL, 1954

INTRODUCTION

The 1954 aerial survey of forest insect conditions in California was flown during the period of September 21 to October 8. As in past surveys, representatives of state, federal and private forestry agencies were included in flights over their respective holdings. Although weather along the north coast caused some delays, flights over all major timber holdings were made, exclusive of the redwood region. Perhaps the most noticeable difference between the 1954 survey and previous surveys was the reduction in time necessary to cover the state. This can be attributed to the use of a Cessna 180 airplane on the survey for the first time. This airplane is much faster and has higher performance standards than the planes used in previous years. A total of 61 hours and 25 minutes were spent on the survey, of which 36 hours and 35 minutes were devoted to actual survey time and 24 hours and 50 minutes to ferry time.

OBJECTIVES

Primarily the annual aerial survey is aimed at discovering any infestations which have not been reported during the course of seasonal ground detection surveys. At the same time the survey provides a picture of general conditions over the state which can be compared with previous years' surveys. Generally speaking, the aerial survey is planned to cover as much of the timbered area of California as time and financing will allow. During the course of the work every effort is made to find ways and means of improving operations to make the survey more efficient and more effective.

PREPARATIONS

Well in advance of the actual survey, letters were sent to interested forest management agencies throughout the state informing them of the tentative schedule and inviting their participation.

Inasmuch as the surveys have never been preplanned as to flight lines but rather by national forests, there has been very little office preparation. The assembling of $\frac{1}{4}$" = 1 mile maps of each national forest, necessary colored pencils, erasers, rubber bands and the aluminum backing sheets for the maps has constituted the office preparation.

EQUIPMENT AND PERSONNEL

A Cessna 180 aircraft, from the Agricultural Research Service, Beltsville, Maryland, was used on the survey. This is a high-wing, single-engine, four-place, all-metal airplane. It is capable of cruising speeds near 150 miles per hour,

yet performs well at speeds of less than 100 miles per hour, which are necessary on many survey flights. It is also capable of attaining altitudes above 11,000 feet, fully loaded, with considerable ease. This has not been the case with past aircraft used on the California aerial survey.

Personnel participating in the survey included the following: Pilots Norman Meyer and Val Mackiewicz, Agricultural Research Service, Beltsville, Maryland; observers Robert H. Cope, George L. Downing and Ralph C. Hall of the California Forest and Range Experiment Station, Berkeley, California; cooperators: Forest Service (15), California State Division of Forestry (4), National Park Service (3) and private foresters (9). This is a total of 36 participating individuals. In addition, Lem Hastings of Walker Forests Co. hired a plane to cover the Walker Forests' holdings, and was accompanied on this flight by M. M. Furniss of the Berkeley Station. No serious loss was noted on this flight.

SURVEY TECHNIQUE

As in the past, no predetermined flight lines were used. Tracking was done in flight and the flight line sketched on the map as the flight progressed. Mapping of infestations was also done as the flight progressed over the infestation areas. Tracking and mapping were done by the observer, assisted in many cases by the pilot. Immediately prior to each flight the current known infestations in the area to be visited were discussed with the land-management representative present. This was done to insure coverage of known infestation areas. The following color-symbol combinations were used in sketch-mapping infestations:

Symbol	Insect
	Defoliator
	Western pine beetle, Jeffrey pine beetle
	Pine engraver
	Mountain pine beetle (L - Lodgepole pine (S - Sugar pine
	Fir engraver
	Douglas-fir beetle

Relative Degree of Infestation

Light ——— Moderate ——— Heavy ———

Flight Lines

10/1/54 → Arrow designates the direction flight was made. Date is placed along flight line, usually near the edge of the map. This is done for future reference.

OPERATION

The survey crew made daily inquiries of the Berkeley office to find out which cooperators wished to accompany the survey crew over their holdings. Once it was known who would accompany the survey crew, arrangements were made with these individuals by telephone, usually two days in advance of the actual flight.

The following table briefly summarizes the operational phase of the 1954 aerial survey of California:

(See Page 4)

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
	(N. Meyer pilot on all flights to 9/23)					
9/21	Downing	Orleans AP	- - -	-	1:10	
9/22	Downing; F.E.Tucker, Klamath N.F.	Yreka, Siskiyou Co.AP	Klamath N.F.	:40	:10	Heavy DF loss to DF beetle in Thompson Ck. drainage; moderate Db-caused loss in pine around old burn N. of Seiad Valley; moderate Db-caused pine loss S. of Round Mtn. N. of Oak Knoll G.S.; light Db-caused pine loss scattered between Daggett Ck. and Middle Ck. N. of Cherry Flat G.S. and S. of Dry Lake.
9/22	Downing:F.E.Tucker and S.D.Hall, Klamath N.F.	Happy Camp AP	Klamath N.F.	1:55		Moderate DF loss to DF beetle in Indian Ck. above the S.Fk. junction; light DF loss in Mill Ck.; known moderate to heavy DF loss to DF beetle along both sides of Klamath River between Happy Camp and Somes Bar; known moderate DF loss along N. side of Salmon River between Somes Bar and Sawyers Bar.
9/22	Downing; F.E.Tucker, Klamath N.F.	Happy Camp AP	Klamath N.F.	:30	:10	Heavy DF loss to DF beetle between China Ck. and Gridder Ck. 6 mi. SW of Seiad Valley; moderate DF loss in upper part of Walker Ck.; light DF loss at head of Tompkins Ck.; light DF loss in Canyon Ck. S. of Kelsey Ck. G.S.; moderate pine loss to Db 3 to 4 mi. N. of Moffett Ck. school.
9/22	Downing; Cope	Yreka, Siskiyou Co. AP	Klamath N.F.	:20	:20	Known DF loss on S. side of Salmon River between Sawyers Bar and Somes Bar; known DF loss between Orleans Mtn. and Le Perron Pk.

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
9/22	Cope	Orleans AP	- - -	-	:40	
9/22	Cope (V. Mackiewicz pilot on all flights from 9/24 to 10/9)	Yreka, Siskiyou Co.AP	- - -	-	:40	
9/24	Cope; N.E. Dole, Shasta-Trinity NF	Redding Benton Fld.	South half Shasta-Trinity N.F.	1:30		Moderate DF loss to DF beetle along S. Fk. of Trinity River between Forest Glen G.S. and Dark Canyon Ck. on the E. Fk. of the S. Fk.; light DF loss between Cave Ck. and S. Rattlesnake Ck.; light DF loss along Trinity River just S. of Hyampom; light DF loss midway up Price Ck. and between Price Ck. and Big Bar Ck.
9/24	Cope; V.S.Brown, Shasta-Trinity NF	Redding Benton Fld.	North half, Shasta-Trinity N.F.	2:00		Light Db-caused loss in pine 2 mi. W. of Altoona; light Db-caused loss in pine near Pigeon Hill; light pine loss at head of Nelson Cr., S. of Red Mtn.
9/27	Cope; Wm.Beaty, Shasta For. Co.; P.Cox, CDF	Redding, Benton Fld.	Private lands E. of Redding and part of Lassen N.F.	1:05	:20	No important loss noted.
9/27	Cope	Redding, Benton Fld.	- - -		:35	
9/27	Hall; J.S.Woolfolk, Lassen N.F.	Fall River Mills AP	Lassen N.F.	1:05		Known light loss in Raker Pk., Badger Mtn. area; no other important loss noted.

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
9/27	Cope	Fall River Mills AP	- - -		:30	
9/28	Cope	Redding, Benton Fld.	- - -		:30	
9/28	Cope;Wm.Welder, Fruit Growers Supply Co.; R. Leatherman, McCloud River Lbr. Co.	Fall River Mills AP	Private lands, Shasta-Trinity NF W.&W. of Fall River	1:30		No important loss noted.
9/28	Cope; E.Lamp, NPS; I.E.Toler, Scott Lbr. Co.	Fall River Mills AP	Lassen NP and Scott Lbr.Co. lands	1:05		Known pine losses in Raker Pk.-Badger Mtn. area; known moderate pine loss in Butte Lake area.
9/28	Cope	Fall River Mills AP	- - -		:30	
9/28	Cope; R.H.Cron, Modoc N.F.	Alturas AP	Modoc N.F.	1:00		Light pine loss to Db N. of Blue Lake in So. Warner Mtns.; light pine loss along N. Fk. of Cherry Ck. in So. Warner Mtns.; light pine loss along the Middle Fk. of Parker Ck. in So. Warner Mtns.; light pine loss 3 mi. N. of Hayden Hill LO.
9/28	Cope	Alturas AP	Modoc N.F.	:55	:10	
9/29	Cope	Fall River Mills AP	- - -		:30	
9/29	Cope; H.F.Wise Plumas N.F.	Chester AP	Plumas N.F.	1:50		Moderate pine loss on S. side of Grizzly Valley; moderate damage occurring in pine just N. of Mt. Hough LO, probably a defoliator. Area relatively free of loss.

DATE	FLIGHT PERSONNEL	FLOWN FROM-	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
9/29	Cope	Chester AP	- - -		:30	
9/29	Cope	Redding Benton Fld.	Six Rivers NF	1:05	:50	Known heavy DF loss caused by the DF beetle throughout the Klamath River and Trinity River drainages.
9/30	Cope	Redding, Benton Fld.	- - -		:50	
9/30	Cope; D.Leise, Mendocino NF	Willows AP	Mendocino NF	1:15		Moderate to light pine loss N. of Goat Mtn. LO; moderate Db-caused pine loss 2 mi. NE of Haydon Rock; light Db-caused loss N. of Hull Mtn. LO; light Db-caused loss on Brushy Camp Ridge; light pine loss to Db N. of Poison Rock LO; light pine loss 2 mi. NW of Shell Mtn. LO.
9/30	Cope	Willows AP	- - -		:45	
10/1	Cope; C.Arment, Diamond Match Co.; J. Denny, CDF	Chico AP(w/ stop at Redding, Benton Fld.)	Westside Plumas N.F.	2:20	:30	Moderate pine loss 2 mi. S. of Big Bar LO; moderate loss of unknown cause 3 mi. W. of Stirling City; light pine loss to Db just N. of Oregon Pk. LO; light pine loss to Db just S. of Pike Pk. LO; light pine loss 2 mi. W. of Mooretown G.S.; light pine loss at lower end of Haphazard Ck.; light pine loss to Db in Flea Valley.
10/1	Cope	Chico AP	- - -		1:20	
10/4	Cope	Concord AP	- - -		:45	
10/4	Cope; Branagh, Tahoe N.F.; E.E.Bailey,CDF	Placerville AP (w/stops at Auburn AP and Reno, Hubbard Fld.)	Tahoe NF and private land W. of Tahoe NF	1:50	:30	No important loss noted.

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
10/4	Cope; A.R.Schmidt, Eldorado NF	Placerville AP	Eldorado NF	1:00		Moderate Dm activity in pine 1 mi. S. of Bunker Hill LO; light Dm activity in pine 5 mi. NE of Bunker Hill LO; light Dm caused loss in LP in vicinity of McKinney Lake; light pine loss at N. end of Fallen Leaf Lake.
10/4	Hall; Wm.Berry, Calif.Foresteering	Placerville AP	Eldorado NF lands on both sides of Hwy 50	1:00		No important loss noted.
10/5	Downing	Placerville AP	- - -		:45	
10/5	Downing; H.Norton, Tahoe Tbr. Co.; R. Henthorne, Toiyabe NF	Reno, Hubbard Fld.	Toiyabe NF & private holdings W. of Reno	:50		Heavy known pine loss to Dm on hill above Crystal Bay, Lake Tahoe; light to moderate pine loss along Bald Mtn. Range; light pine loss both E. & W. of Baffitt LO; light pine loss 2 mi. W. of Peavine Pk. LO; light pine loss near Bender LO.
10/5	Downing	Reno Hubbard Fld.	- - -		:45	
10/5	Downing; S.Bryan, Calaveras Land & Tbr.Co.; Wm. Kupholdt, Blagen Lbr Co.	San Andreas AP	Private holdings E. of San Andreas	:30		Moderate pine loss at Doud Hill; light pine loss 3 mi. W. of Avery.
10/5	Downing; E.E.Bailey, CDF	San Andreas AP	- - -		:15	
10/5	Downing; E.E.Bailey, CDF; S.C.Parker, Stanislaus NF	Columbia AP	Stanislaus NF and private land to W. of Stanislaus NF	:50		Moderate pine loss 2 to 3 mi. SW. of McCormick LO; light pine loss 1 mi. E. of American Hill LO; light pine loss 2 mi. NE of McCormick LO; light pine loss 2 mi. NE of Woods Ridge LO; light pine loss 3 mi. SE of Pilot Pk. LO.

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
10/5	Downing; E.E.Bailey, CDF	Columbia AP	Private land between Columbia and San Andreas	:35		Heavy known pine loss to Ips and Db at River Pines; moderate pine loss to Ips and Db 3 mi. N. of Murphy's; moderate pine loss at Esperanza CDF; moderate pine loss to Ips and Db 2 mi. E. of Pine Grove; moderate pine loss to Ips and Db near Ft. Ann Mine; moderate pine loss 1 mi. S. of Wilseyville.
10/5	Downing	San Andreas AP	- - -		1:20	
10/6	Downing	Fresno, Chandler Fld.	- - -		:30	
10/6	Downing; E.Ernst, Yosemite NP	Mt.Bullion AP	Yosemite NP	1:50		Known heavy defoliation of JP by lodgepole needle miner in upper Tuolumne River watershed; known heavy losses in LP due to Dm in Conness and McCabe Basins; moderate pine loss at lower end of Bishop Ck.; moderate top-killing by Ips along Avalanche Ck.
10/6	Downing	Mt.Bullion AP	- - -		:30	
10/6	Downing: C.E. Risbrudt, Sierra NF; D.F.Schlobohm, CDF	Fresno Municipal AP	Sierra NF	1:45		Moderate Ips and Db activity in vicinity of China Wells; moderate Ips and Db activity around Black Rock; moderate Ips and Db-caused loss on Rodgers Ridge immediately S. of Black Rock G.S.; light Db- and Ips-caused loss in pine at N. end of Bass Lake; light Db activity in vicinity of Fawn Mdw.
10/7	Downing	Fresno, Chandler Fld.	- - -		:50	

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
10/7	Downing; B.S.Sweatt, Inyo NF	Deadman Airstrip	Inyo NF	1:10		Known moderate to heavy JP loss from Mc and Dj in Indiana Summit Natural Area; known JP loss due to Mc and DJ in Deadman area; moderate loss ot whitebark pine due to unknown causes 1 mi. NE of Glass Ck. Mdw.
10/7	Downing	Deadman Airstrip	- - -		1:00	
10/7	Downing;R.W.White, Sequoia NF; S. Bectel, Sequoia NP	Porterville AP	Sequoia NP and NF	1:45		Heavy tip-killing of pine from unknown cause along McKenzie Ridge; moderate Ips top-killing of pine on NE side of Delilah LO; moderate pine loss 2-3 mi. S. of the Needles LO; moderate IP loss from Dm 3 mi. NE of Maggie Mtn.; moderate WF loss to Sv 2 mi. NE of Jordan Pk.; moderate to heavy damage to fir from Sv and mistletoe between Quaking Aspen G.S. and Peppermint Ck.; moderate to heavy damage to fir from Sv and mistletoe for several miles S. of Johnsondale; light fir loss to Sv just S. of Mineral King; light fir damage to Sv N. of Sunday Pk. LO.
10/7	Downing	Porterville AP	- - -		:40	
10/8	Downing	Fresno, Chandler Fld.	Los Padres NF and Angeles NF	1:35	1:00	Known heavy JP loss to Mc in Grade Valley; known moderate loss in JP to Mc on Alamo Mtn.; known light to moderate pine and fir losses on Mt. Pinos; known heavy loss of pine and fir in Big Pines area. (Some areas of known insect activity on these two forests were not flown.)

DATE	FLIGHT PERSONNEL	FLOWN FROM	AREA FLOWN	SURVEY TIME	FERRY TIME	OBSERVATIONS
10/8	Downing	San Bernardino AP	San Bernardino NF and Cleveland NF	1:50	:30	Known heavy pine loss to Db in Julian area; known moderate to heavy Jp loss to Dj at Mt. Laguna; known moderate to heavy loss in pine around Dyche Valley; known moderate loss in JP by Mc around Garner Valley; known moderate JP loss to Dj in Big Bear area; known JP losses E. of Barton Flats.
10/8	Mackiewicz alone	San Bernardino AP	- - -		1:20	
10/9	Mackiewicz alone	Needles AP	- - -		3:10	(To Albuquerque, New Mexico)

Airports

As an aid to those persons preparing for the annual statewide aerial survey, a suggested list of airports was included in the report on the 1953 aerial survey. This list has been added to from experience gained on the 1954 survey, and should prove of value to any future aerial surveys, particularly where cooperators are to be flown. In addition, the Forest Service Region 5 has available in mimeograph form a list of airport facilities in California as part of the dispatchers red book. This can be secured upon request to the Regional Office, San Francisco.

An up-to-date Airman's Guide should be carried by the crew and consulted to determine the state of repair of any airport to be used.

Suggested List of Airports

Area to be Flown	City and Airport
Modoc National Forest	Fall River Mills AP Alturas AP
Lassen National Park	Fall River Mills AP Chester AP Redding, Benton Field
Lassen National Forest	Fall River Mills AP Chester AP Redding, Benton Field
Plumas National Forest	Chester AP
Tahoe National Forest	Auburn AP Marysville AP
Eldorado National Forest	Placerville AP San Andreas AP Jackson AP
Stanislaus National Forest	San Andreas AP Columbia AP Jackson AP
Sierra National Forest	Fresno, Chandler Field Mt. Bullion AP (Great Western)
Yosemite National Park	Fresno, Chandler Field Mt. Bullion AP
Sequoia National Park	Visalia AP Porterville AP
Sequoia National Forest	Porterville AP Visalia AP

Inyo National Forest	Bishop AP Deadman Airstrip
Toiyabe National Forest	Reno, Hubbard Field Carson City AP
Six Rivers National Forest	Eureka AP Orleans AP
Klamath National Forest	Yreka, Siskiyou County AP Happy Camp AP
Shasta-Trinity National Forest	Redding, Benton Field Mt. Shasta City, Matt Field Weaverville AP Fall River Mills AP
Mendocino National Forest	Willows AP
Los Padres National Forest	Santa Barbara AP Bakersfield AP
Angeles National Forest	Ontario International AP (Avoid Burbank AP and Inglewood AP - heavy smog and heavy air traffic)
San Bernardino National Forest	San Bernardino AP Banning AP
Cleveland National Forest	Ramona AP El Cahon. San Diego AP

The following airports have proven to be most desirable as main bases of operation for each of the following major areas:

Area	City and Airport
Northeastern California	Fall River Mills AP
Central Sierra	Placerville AP
Southern Sierra	Fresno, Chandler Field
North Coast	Redding, Benton AP
Southern California	San Bernardino AP

This is by no means a complete list of available airports from which the above-mentioned areas can be flown. This list should be added to following the completion of each year's aerial survey. Notes should be taken concerning any airport found to be undesirable for this type of flying.

Costs

Survey costs were as follows:

*Salaries	$456.00
**Per diem & miscellaneous expenses	$570.75
Airplane operation & maintenance	$316.78
Approximate acreage surveyed	15,000,000
Total flying time	61:25 hours
Average total cost per hour	$ 21.88
Average cost per hour of aircraft operation	$ 4.92
Approximate cost per 1000 acres	$ 00.09

*Includes salaries of participating personnel from the California Forest and Range Experiment Station only. The pilot's salary was paid by the Agricultural Research Service, Beltsville, Maryland.

**Includes per diem, telephone calls, ground transportation, and minor incidental expenses incurred by the pilot and participating Experiment Station personnel.

DISCUSSION AND RECOMMENDATIONS

The report following the 1953 aerial survey of California mentioned the need for an airplane having a higher performance standard than the Cessna 170-B which had been used on that and several previous aerial surveys. The Agricultural Research Service, Beltsville, Maryland, recognized this need and made available a Cessna 180 for this year's survey. This airplane performs in accordance with the standards considered desirable, if not necessary, to the achievement of a successful statewide aerial survey of California. Certainly, this airplane is to be recommended for any further aerial survey work conducted under the conditions as they exist here in California.

There are many places in the present survey where changes can be made to strengthen its effectiveness. These have to do mainly with increased intensity of coverage and reduced duplication of effort. Under our present system, coverage of the State has been a process of evaluation, which in some areas is adequate and in others leaves a great deal to be desired. It is this writer's opinion that, to increase the effectiveness of the survey and to also provide a better basis for evaluating the coverage obtained, a systematic review of techniques used in other areas, particularly the Oregon-Washington aerial surveys, is needed. Perhaps preplanned flight lines could be determined for the entire State, working out of two or three airfields. This would have many advantages over the present system in that practically every minute in the air could be used in actual survey time rather than the unavoidable ferry time being spent under the present setup. Further, a definite pattern of coverage should be worked out for the State. There are undoubtedly areas where a grid system would work best; others where, owing to the topography involved, contouring should be used; and still others, where combinations of the two or modifications of these or possibly other systems should be employed. Up to the present time, very little effort has been made to definitely outline the areas to be surveyed, other than to generally fly the

major drainages or attempt some sort of a pattern coverage of each area as the flights were made over them. Practically no office time has been devoted to planning flight lines other than the designation of broad areas to be covered on a day by day basis as the survey progressed. This lack of preplanning has been a result of our present system of flying cooperators over their lands while the survey is in progress. Although this cooperative approach has merit, it does involve added expense to the survey. There are so many cooperators in the State that it means some duplication of effort and at the same time all but eliminates the possibility of preplanned flight lines. Perhaps a solution to this problem would be the scheduling of but one or two industry representatives and/or State Division of Forestry personnel to fly as part of the survey crew out of each major airport. That would mean that no more than half a dozen State and industry representatives would fly on the survey and that they would all be available at the two or three airports to be used on the survey. This would eliminate the practice now in effect of flying to pick up personnel at outlying airports. If such a plan is used, the men picked to accompany the regular survey crew can be men with experience in aerial observation and they can be more profitably fitted into the actual planned survey procedure. This has not been the case to date.

Briefly, the suggested plan is the reduction of cooperative participation to no more than half a dozen persons and the preplanning of the entire survey so that predetermined flight lines can be drawn on the maps. These flight lines should be based on a definite system after a review of work in other regions.

If such a plan is to be developed, it can be worked out at any time during the year and assembled in a manner that will require very little work immediately prior to the actual survey in the fall of the year. The first year's planning will be a time-consuming job. Once a satisfactory plan is developed, it should be a relatively simple job to get the survey going each year.

Berkeley, California
March 29, 1955

G. L. Downing
Entomologist